

A microscopic view of several sperm cells, showing their long, thin tails and oval heads, set against a dark purple background with a green gradient on the left side.

Male Reproductive System

9

INTRODUCTION

The male sex cell, the **spermatozoon** (sperm cell), is microscopic—in volume, only one third the size of a red blood cell and less than 1/100,000 the size of the female ovum. A relatively uncomplicated cell, the sperm is composed of a head region, containing nuclear hereditary material (chromosomes), and a tail region, consisting of a **flagellum** (hair-like process). The flagellum makes the sperm motile and makes it look somewhat like a tadpole. The spermatozoon cell contains relatively little food and cytoplasm, because it lives only long enough to travel from its point of release from the male to where the egg cell lies within the female reproductive tract (fallopian tube). Only one spermatozoon out of approximately 300 million sperm cells released during a single **ejaculation** (ejection of sperm and fluid from the male urethra) can penetrate a single ovum and result in fertilization of the ovum.

If more than one egg is passing down the fallopian tube when sperm are present, multiple fertilizations are possible, and twins, triplets, quadruplets, and so on may occur. Twins resulting from the fertilization of separate ova by separate sperm cells are called **fraternal twins**. Fraternal twins, developing with separate placentas, can be of the same sex or different sexes and resemble each other no more than ordinary brothers and sisters. Fraternal twinning is hereditary; the daughters of mothers of twins can carry the gene.

Identical twins result from fertilization of a single egg cell by a single sperm. As the fertilized egg cell divides and forms many cells, it somehow splits, and each part continues separately to undergo further division, each producing an embryo. Most identical twins have one placenta and two amniotic sacs. Identical twins are always of the same sex and are very similar in form and feature.

The organs of the male reproductive system are designed to produce and release billions of spermatozoa throughout the lifetime of a male from puberty onward. In addition, the male reproductive system secretes a hormone called **testosterone**. Testosterone is responsible for the production of the bodily characteristics of the male (such as beard, pubic hair, and deeper voice) and for the proper development of male gonads (**testes**) and accessory organs (**prostate gland** and **seminal vesicles**) that secrete fluids to ensure the lubrication and viability of sperm.

ANATOMY

Label Figure 9-1 as you study the following description of the anatomy of the male reproductive system.

Each male gonad is a **testis** [1]. There are two **testes** (plural) or **testicles** that develop in the abdomen at about the level of the kidneys before descending during embryonic development into the **scrotum** [2], a sac enclosing the testes on the outside of the body.

The scrotum, lying between the thighs, exposes the testes to a lower temperature than that of the rest of the body. This lower temperature is necessary for the adequate maturation and development of sperm (**spermatogenesis**). Located between the anus and the scrotum, at the floor of the pelvic cavity in the male, the **perineum** [3] is analogous to the perineal region in the female.

The interior of a testis is composed of a large mass of narrow, coiled tubules called the **seminiferous tubules** [4]. These tubules contain cells that manufacture spermatozoa. The seminiferous tubules are the **parenchymal tissue** of the testis, which means that they perform the essential work of the organ (formation of sperm). Other cells in the testis, called **interstitial cells**, manufacture an important male hormone, **testosterone**.

All body organs contain **parenchyma**, which perform the essential functions of the organ. Organs also contain supportive, connective, and framework tissue, such as blood

vessels, connective tissues, and sometimes muscle as well. This supportive tissue is called **stroma (stromal tissue)**.

After formation, sperm cells move through the seminiferous tubules and collect in ducts that lead to a large tube, the **epididymis** [5], at the upper part of each testis. The spermatozoa mature, become motile in the epididymis, and are temporarily stored there. An epididymis runs down the length of each testicle (the coiled tube is about 16 feet long) and then turns upward again and becomes a narrow, straight tube called the **vas deferens** [6] or **ductus deferens**. Figure 9-2 shows the internal structure of a testis and the epididymis. The vas deferens is about 2 feet long and carries the sperm up into the pelvic region, at the level of the urinary bladder, merging with ducts from the **seminal vesicles** [7] to form the **ejaculatory duct** [8] leading toward the urethra. During a **vasectomy** or **sterilization** procedure, the urologist cuts and ties off each vas deferens by making an incision in the scrotum.

The seminal vesicles, two glands (only one is shown in Figure 9-1) located at the base of the bladder, open into the ejaculatory duct as it joins the **urethra** [9]. They secrete a thick, sugary, yellowish substance that nourishes the sperm cells and forms a portion of ejaculated semen. **Semen**, a combination of fluid (seminal fluid) and spermatozoa (sperm cells account for less than 1% of the semen volume), is ejected from the body through the urethra. In the male, as opposed to that in the female, the genital orifice combines with the urinary (urethral) opening.

The **prostate gland** [10] lies at the region where the vas deferens enters the urethra, almost encircling the upper end of the urethra. It secretes a thick fluid that, as part of semen, aids the motility of the sperm. The muscular tissue of the prostate aids in the expulsion of fluid during ejaculation. About 40% of ejaculate comes from seminal vesicles and 60% from the prostate. **Bulbourethral glands** [11], lying below the prostate gland, also secrete fluid into the urethra.

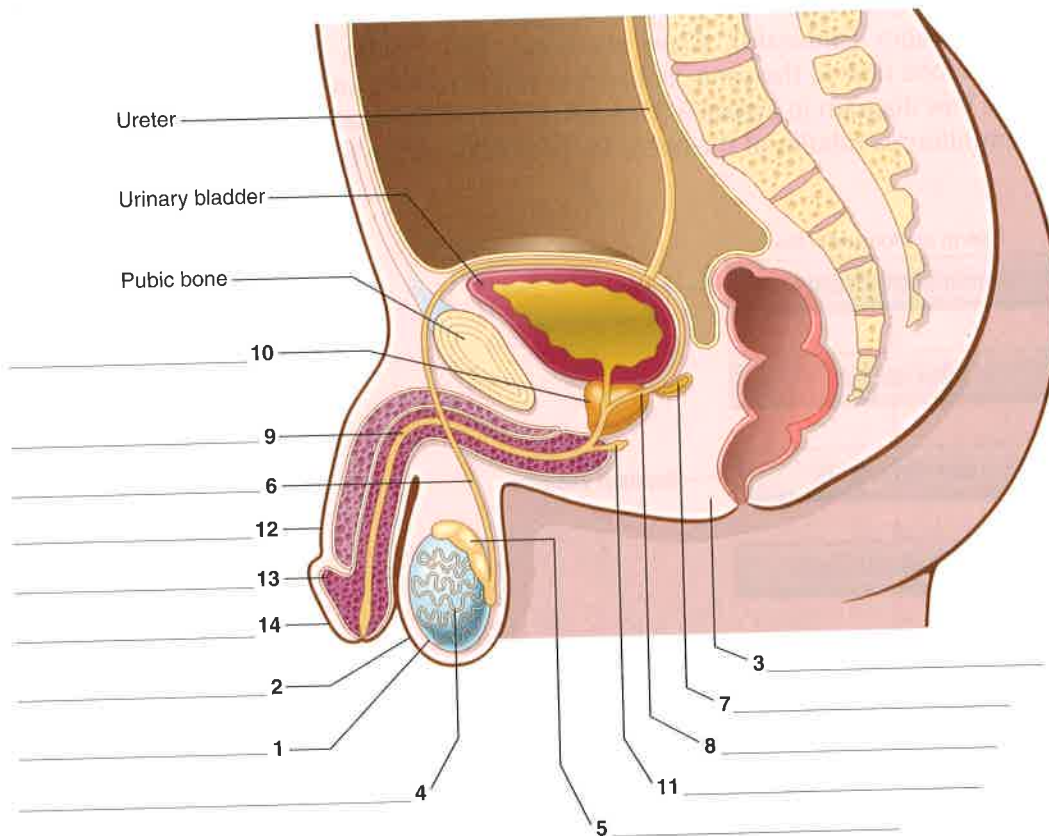


FIGURE 9-1 Male reproductive system, sagittal view.

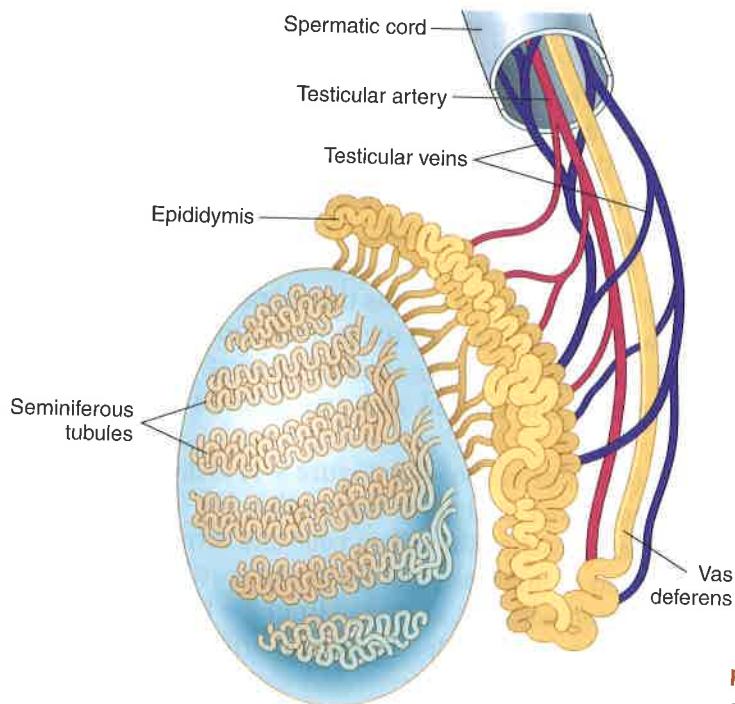


FIGURE 9-2 Internal structure of a testis and the epididymis.

The urethra passes through the **penis** [12] to the outside of the body. The penis is composed of erectile tissue and at its tip expands to form a soft, sensitive region called the **glans penis** [13]. Ordinarily, a fold of skin called the **prepuce**, or **foreskin** [14], covers the glans penis. During a circumcision the foreskin is removed, leaving the glans penis visible at all times.

Erectile dysfunction (impotence) is the inability of the adult male to achieve an erection. Viagra (sildenafil), Cialis (tadalafil), and Levitra (vardenafil) are drugs that increase blood flow to the penis, enhancing ability to have an erection.

The flow diagram in Figure 9-3 traces the path of spermatozoa from their formation in the seminiferous tubules of the testes to the outside of the body.

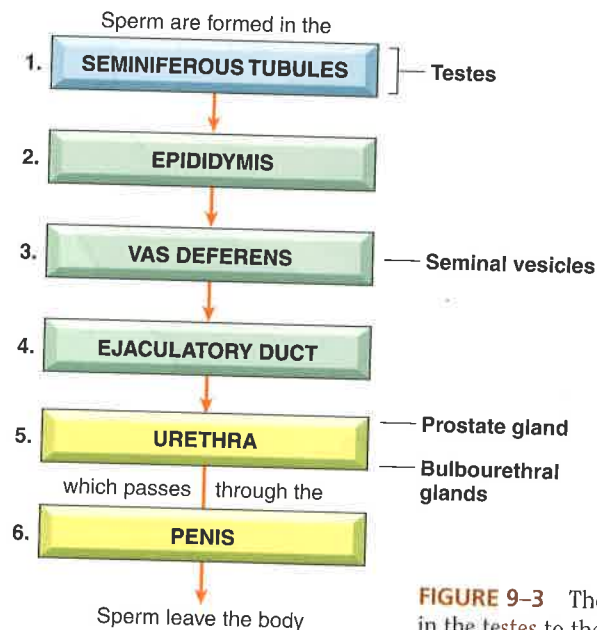


FIGURE 9-3 The passage of sperm from the seminiferous tubules in the testes to the outside of the body.



VOCABULARY

This list reviews new terms introduced in the text. Short definitions reinforce your understanding.

bulbourethral glands	A pair of exocrine glands near the male urethra. They secrete fluid into the urethra. Also called Cowper glands.
ejaculation	Ejection of sperm and fluid from the male urethra.
ejaculatory duct	Tube through which semen enters the male urethra.
epididymis (plural: epididymides)	One of a pair of long, tightly coiled tubes on top of each testis. It carries sperm from the seminiferous tubules to the vas deferens.
erectile dysfunction	Inability of an adult male to achieve an erection; impotence.
flagellum	Hair-like projection on a sperm cell that makes it motile (able to move).
fraternal twins	Two infants born of the same pregnancy from two separate egg cells fertilized by two different sperm cells (Figure 9-4).
glans penis	Sensitive tip of the penis.
identical twins	Two infants resulting from division of one fertilized egg into two distinct embryos. Conjoined (“Siamese”) twins are incompletely separated identical twins.
parenchyma	The essential distinctive cells of an organ. In the testis, the seminiferous tubules that produce sperm are the parenchymal tissues.
penis	Male external organ of reproduction.

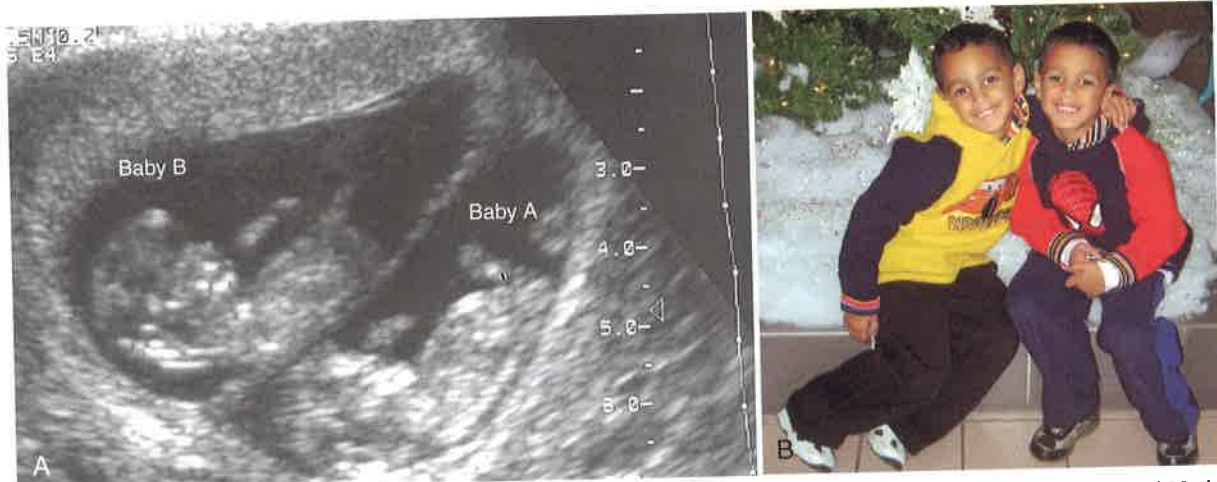




FIGURE 9-4 Fraternal twins. (A) Notice the 6-week-old embryos in two separate amniotic sacs. (B) Twins Marcos and Matheus Do Carmo are 5 years old. (Courtesy Juliana Do Carmo.)

perineum	External region between the anus and scrotum in the male.
prepuce	Foreskin; fold of skin covering the tip of the penis.
prostate gland 	Exocrine gland at the base of the male urinary bladder. The prostate secretes the fluid part of semen into the urethra during ejaculation.
scrotum	External sac that contains the testes.
semen 	Spermatozoa (sperm cells) and seminal fluid (prostatic and seminal vesicle secretions).
seminal vesicles	Paired sac-like male exocrine glands that secrete fluid (a major component of semen) into the vas deferens.
seminiferous tubules	Narrow, coiled tubules that produce sperm in the testes.
spermatozoon (plural: spermatozoa)	Sperm cell.
sterilization	Procedure that removes an individual's ability to produce or release reproductive cells.
stroma	Supportive, connective tissue of an organ, as distinguished from its parenchyma.
testis (plural: testes)	Male gonad (testicle) that produces spermatozoa and the hormone testosterone. <i>Remember:</i> testis means one testicle, and testes are two testicles.
testosterone	Hormone secreted by the interstitial tissue of the testes; responsible for male sex characteristics.
vas deferens	Narrow tube (one on each side) that carries sperm from the epididymis into the body and toward the urethra. Also called ductus deferens.

**Prostate/Prostrate**

Don't confuse *prostate* with *prostrate*, which means lying down.

**Semen/Sperm**

Don't confuse *semen* with *sperm*. *Semen* is the thick, whitish secretion discharged from the urethra during ejaculation. It contains *sperm* (spermatozoa), cells that develop in the testes.



TERMINOLOGY

Write the meanings of the medical terms in the spaces provided.

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
andr/o	male	<u>androgen</u> _____ <i>Testosterone is an androgen. The testes in males and the adrenal glands in both men and women produce androgens.</i>	
balan/o	penis (Greek <i>balanos</i> , acorn)	<u>balanitis</u> _____ <i>An inflammation usually caused by overgrowth of organisms (bacteria and yeast) (Figure 9-5A).</i>	
cry/o	cold	<u>cryogenic surgery</u> _____ <i>Technique for prostate cancer treatment using freezing temperatures to destroy cancer cells.</i>	
crypt/o	hidden	<u>cryptorchidism</u> _____ <i>In this congenital condition, one or both testicles do not descend, by the time of birth, into the scrotal sac from the abdominal cavity (Figure 9-5B).</i>	
epididym/o	epididymis	<u>epididymitis</u> _____ <i>This is an inflammation usually caused by bacteria. Symptoms are fever, chills, pain in the groin, and tender, swollen epididymis.</i>	
gon/o	seed (Greek <i>gone</i> , seed)	<u>gonorrhea</u> _____ <i>See page 323.</i>	
hydr/o	water, fluid	<u>hydrocele</u> _____ <i>See page 320.</i>	

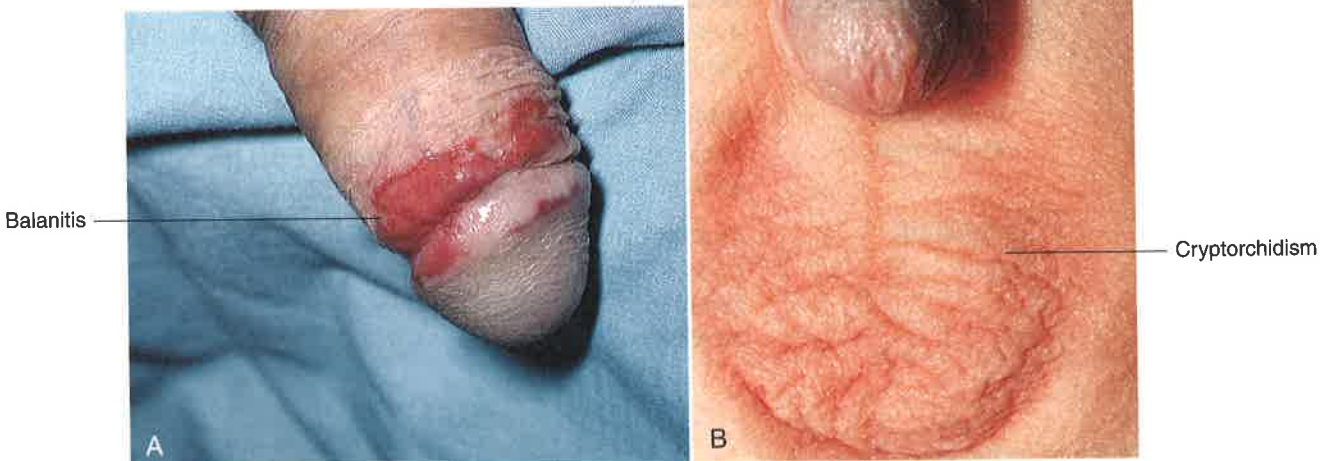



FIGURE 9-5 (A) Balanitis. (B) Cryptorchidism. (A, From Callen JP et al: *Color Atlas of Dermatology*, 2nd ed., Philadelphia, 2000, Saunders; B, from Zitelli BJ, Davis HW: *Atlas of Pediatric Physical Diagnosis*, 2nd ed., St. Louis, Mosby, 1992.)

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
orch/o, orch/o, orchid/o 	testis, testicle	<u>orch</u> ectomy _____ <i>Castration in males. (Also called orchidectomy.)</i>	
		<u>orch</u> itis _____ <i>Caused by injury or by the mumps virus, which also infects the salivary glands.</i>	
pen/o	penis	<u>pen</u> ile _____ <i>-ile means pertaining to.</i>	
		<u>pen</u> oscrotal _____	
prostat/o	prostate gland	<u>prostat</u> itis _____ <i>Bacterial (E. coli) prostatitis often is associated with urethritis and infection of the lower urinary tract.</i>	
		<u>prostat</u> ectomy _____	
semin/i	semen, seed	<u>semin</u> iferous tubules _____ <i>The suffix -ferous means pertaining to bearing, or bearing or carrying.</i>	
sperm/o, spermat/o	spermatozoa, semen	<u>sperm</u> olytic _____ <i>Noun suffixes ending in -sis, like -lysis, form adjectives by dropping the -sis and adding -tic.</i>	
		oligo <u>sperm</u> ia _____	
		as <u>perm</u> ia _____ <i>Lack of formation or ejaculation of semen (sperm and fluid).</i>	
terat/o	monster (Greek <i>teras, monster</i>)	<u>terat</u> oma _____ <i>Usually a benign tumor occurring in the testes or ovaries composed of different types of tissue, such as bone, hair, cartilage, and skin cells. Some forms of teratoma are malignant.</i>	
test/o	testis, testicle	<u>testic</u> ular _____ <i>The term testis originates from a Latin term meaning witness. In ancient times men would take an oath with one hand on their testes, swearing by their manhood to tell the truth.</i>	
varic/o	varicose veins	<u>varico</u> cele _____ <i>A collection of varicose (swollen, twisted) veins above the testis. See page 320.</i>	
vas/o	vessel, duct; vas deferens	<u>vas</u> ectomy _____ <i>See page 326. Remember: in this term, vas/o refers to the vas deferens, and not to any other vessel or duct.</i>	
zo/o	animal life	azo <u>osperm</u> ia _____ <i>Lack of spermatozoa in the semen. Causes include testicular dysfunction, chemotherapy, blockage of the epididymis, and vasectomy.</i>	



Derivation of orchid/o

This combining form is derived from the Greek word *orchis* (testicle). The botanical name for orchid, the flower, is also derived from the same Greek word because of the fleshy tubers of the plant.

SUFFIXES

SUFFIX	MEANING	TERMINOLOGY	MEANING
-genesis	formation	spermatogenesis _____	
-one	hormone	testosterone _____	<i>Ster/o indicates that this is a type of steroid compound. Examples of other steroids are estrogen, cortisol, and progesterone.</i>
-pexy	fixation, put in place	orchiopexy _____	<i>A surgical procedure to correct cryptorchidism.</i>
-stomy	new opening	vasovasostomy _____	<i>Reversal of vasectomy; a urologist rejoins the cut ends of the vas deferens.</i>

PATHOLOGIC CONDITIONS; SEXUALLY TRANSMITTED DISEASES

TUMORS AND ANATOMIC/STRUCTURAL DISORDERS

Testes

carcinoma of the testes (testicular cancer)

Malignant tumor of the testicles.

Testicular tumors are rare except in the 15- to 35-year-old age group. The most common tumor, a **seminoma**, arises from embryonic cells in the testes (Figure 9-6A). Nonseminomatous tumors are **embryonal carcinoma** (Figure 9-6B), **teratoma**, **choriocarcinoma**, and **yolk sac tumor**. Teratomas are composed of tissue such as bone, hair, cartilage, and skin cells (terat/o means monster).

Testicular cancers can be treated and cured with surgery (orchietomy), radiotherapy, and chemotherapy. Tumors produce the proteins hCG and alpha-fetoprotein. Serum levels of these proteins are used as **tumor markers** to determine success of treatment.

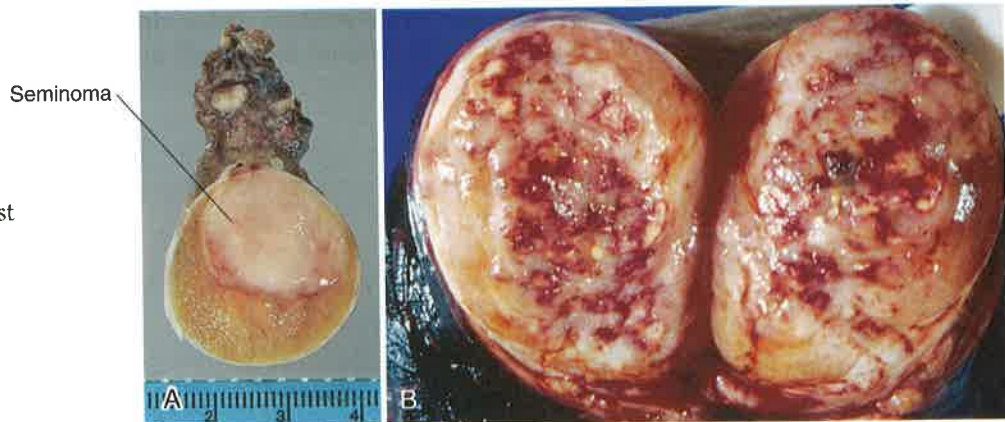


FIGURE 9-6 (A) Seminoma of a testis. (B) Embryonal carcinoma of a testis. In contrast with the seminoma, which is a pale, homogeneous mass, the embryonal carcinoma is a hemorrhagic mass. (From Kumar V, Cotran RS, Robbins SL: Basic Pathology, 7th ed., Philadelphia, Saunders, 2003.)

cryptorchidism; cryptorchism**Undescended testicles.**

Orchiopexy is performed to bring the testes into the scrotum, if they do not descend on their own by the age of 1 or 2 years. Undescended testicles are associated with a high risk for sterility and increased risk of developing testicular cancer.

hydrocele**Sac of clear fluid in the scrotum.**

Hydroceles (Figure 9-7) may be congenital or occur as a response to infection or tumors. Often idiopathic, they can be differentiated from testicular masses by ultrasound imaging. If the hydrocele does not resolve on its own, the sac fluid is aspirated using a needle and syringe, or hydrocelectomy may be necessary. In this procedure, the sac is surgically removed through an incision in the scrotum.

testicular torsion**Twisting of the spermatic cord** (see Figure 9-7).

The rotation of the spermatic cord cuts off blood supply to the testis. Torsion occurs most frequently in the first year of life and during puberty. Surgical correction within hours of onset of symptoms can save the testis.

varicocele**Enlarged, dilated veins near the testicle.**

Varicocele (see Figure 9-7) is associated with oligospermia and azoospermia. Oligospermic men with varicocele and scrotal pain should have a varicocelectomy. In this procedure, the internal spermatic vein is ligated (the affected segment is cut out and the ends are tied off). On occasion, this leads to an increase in fertility.

Prostate Gland**benign prostatic hyperplasia (BPH)****Benign growth of cells within the prostate gland.**

BPH is a common condition in men older than 60 years of age. Urinary obstruction and inability to empty the bladder completely are symptoms. Figure 9-8 shows the prostate gland with BPH and with carcinoma. Surgical treatment by **transurethral resection of the prostate (TURP)** relieves the obstruction, but overgrowth of cells may recur over several years. In this procedure, an endoscope (resectoscope) is inserted into the penis and through the urethra. Prostatic tissue is removed by an electrical hot loop attached to the resectoscope.

Several drugs to relieve BPH symptoms have been approved by the FDA. Finasteride (Proscar) inhibits production of a potent testosterone that promotes enlargement of the prostate. Other drugs, alpha-blockers such as tamsulosin (Flomax), act by relaxing the smooth muscle of the prostate and the neck of the bladder.

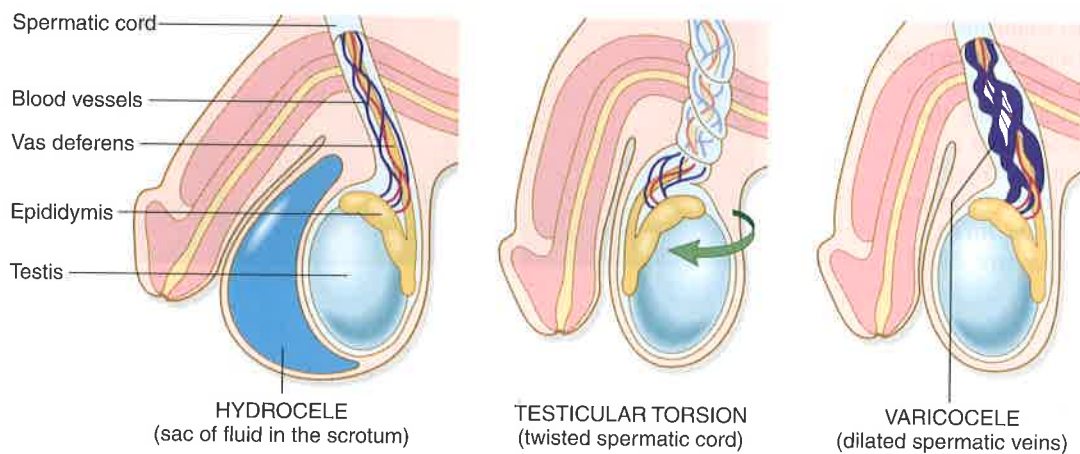
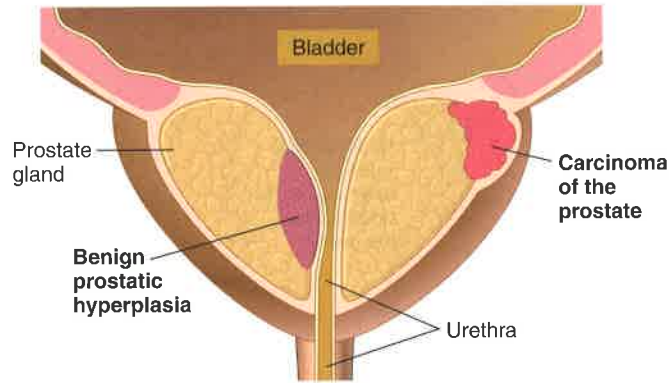


FIGURE 9-7 Hydrocele, testicular torsion, and varicocele.

FIGURE 9-8 The prostate gland with carcinoma and benign prostatic hyperplasia (BPH). Carcinoma usually arises around the sides of the gland, whereas BPH occurs in the center of the gland. Because prostate cancers are located more peripherally, they can be palpated on DRE.



Lasers also may be used to destroy prostatic tissue and relieve obstruction. A **laser TURP** or **GreenLight PVP** procedure uses a green light laser at the end of an endoscope.

carcinoma of the prostate (prostate cancer)

Malignant tumor of the prostate gland.

This cancer commonly occurs in men who are older than 50 years. **Digital rectal examination (DRE)** (Figure 9-9) can detect the tumor at a later stage, but early detection depends on a **prostate-specific antigen (PSA) test**. PSA is a protein that is secreted by tumor cells into the bloodstream. PSA levels are elevated in prostate cancer patients even at an early stage of tumor growth. The normal PSA level is 4.0 ng/mL or less.

Diagnosis requires identification by a pathologist of abnormal prostate tissue in a prostate biopsy. **Transrectal ultrasound (TRUS)** guides the precise placement of the biopsy needle. Multiple needle biopsy specimens are taken through the rectal wall. Computed tomography (CT) detects lymph node metastases.

Treatment consists of surgery (prostatectomy), radiation therapy, and/or hormonal chemotherapy. Because prostatic cells are stimulated to grow in the presence of androgens, antiandrogen hormones slow tumor growth by depriving the cells of testosterone. Prostate cancer also is treated with leupron, a hormone that blocks pituitary stimulation of the testes and reduces the level of androgens in the bloodstream. Radioactive seeds implanted in the prostate also are used to destroy tumor cells.

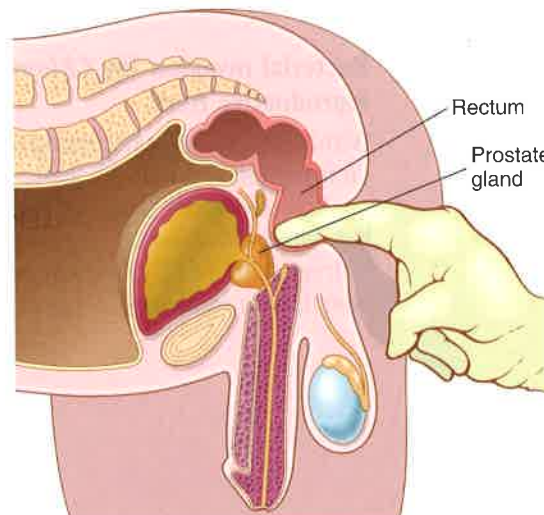


FIGURE 9-9 Digital rectal examination (DRE) of the prostate gland.

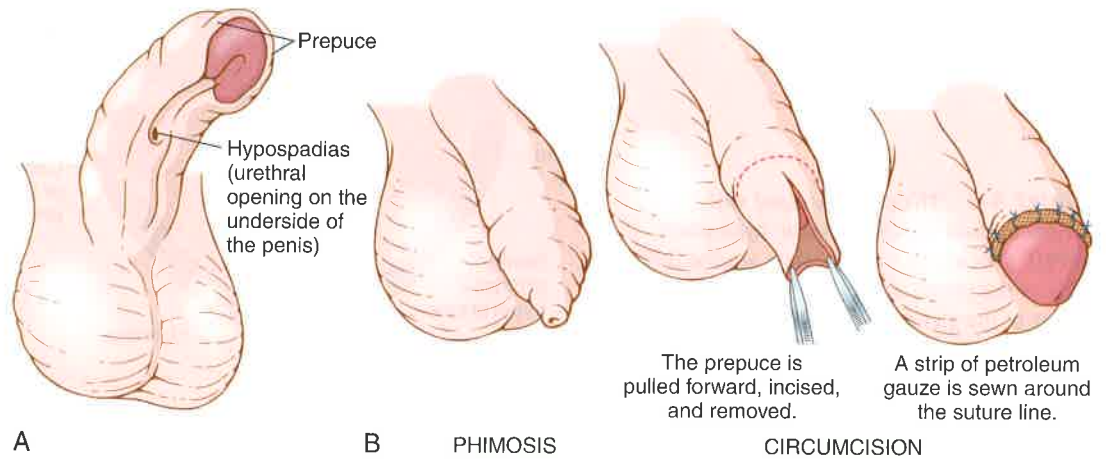


FIGURE 9-10 (A) **Hypospadias**. Surgical repair involves elongating the urethra by using surrounding tissue or using a graft from tissue elsewhere in the body, and bringing it to the exit at the tip of the penis. (B) **Phimosis** and **circumcision** to correct the condition.

Penis

hypospadias; hypospadias

Congenital abnormality in which the male urethral opening is on the undersurface of the penis, instead of at its tip.

Hypospadias (-spadias means the condition of tearing or cutting) occurs in 1 in every 300 live male births and can be corrected surgically (Figure 9-10A).

phimosis

Narrowing (stricture) of the opening of the prepuce over the glans penis.

This condition (phim/o = muzzle) can interfere with urination and cause secretions to accumulate under the prepuce, leading to infection. Treatment is by circumcision (cutting around the prepuce to remove it) (Figure 9-10B).

SEXUALLY TRANSMITTED DISEASES (STDs)

Sexually transmitted diseases (STDs) are infections transmitted by sexual or other genital contact. Also known as sexually transmitted infections (STIs) and venereal diseases (from Latin *Venus*, the goddess of love), they occur in both men and women and are some of the most prevalent communicable diseases in the world.

chlamydial infection

Bacterial invasion (by *Chlamydia trachomatis*) of the urethra and reproductive tract.

Within 3 weeks after becoming infected, men may experience a burning sensation on urination and notice a white or clear discharge from the penis.

Infected women may notice a yellowish vaginal discharge (from the endocervix), but often the disease is asymptomatic. Antibiotics cure the infection, but if untreated, this STD can cause salpingitis (pelvic inflammatory disease [PID]) and infertility in women.

gonorrhea**Inflammation of the genital tract mucosa, caused by infection with gonococci (berry-shaped bacteria).**

Other areas of the body, such as the eye, oral mucosa, rectum, and joints, may be affected as well. Signs and symptoms include dysuria and a yellow, mucopurulent (**purulent** means pus-filled) discharge from the male urethra (Figure 9-11A). The ancient Greeks mistakenly thought that this discharge was a leakage of semen, so they named the condition gonorrhea, meaning discharge of seed (gon/o = seed).

Many women carry the disease asymptotically, whereas others have pain, vaginal and urethral discharge, and salpingitis (PID). As a result of sexual activity, men and women can acquire anorectal and pharyngeal gonococcal infections as well. Chlamydial infection and gonorrhea often occur together. When treating these infections, doctors give antibiotics for both and treat both partners.

herpes genitalis**Infection of skin and genital mucosa, caused by the herpes simplex virus (HSV).**

Most cases of herpes genitalis are caused by HSV type 2 (although some are caused by HSV type 1, which commonly is associated with oral infections such as cold sores or fever blisters). The usual clinical presentation is reddening of skin with formation of small, **fluid-filled blisters** and ulcers (Figure 9-11B). Initial episodes also may involve inguinal lymphadenopathy, fever, headache, and malaise. Remissions and relapse periods occur; no drug is known to be effective as a cure. Neonatal herpes is a serious complication that affects infants born to women with active infection near the time of delivery. Gynecologists may deliver infants by cesarean section to prevent infection of these babies by HSV. Studies suggest that women with herpes genitalis have a higher risk of developing vulvar and cervical cancer.

human papillomavirus (HPV) infection**Infection of the skin and mucous membranes in the anogenital region by the human papillomavirus.**

Some types of HPV cause genital warts and can cause cancer of the cervix as well as cancer in men. A vaccine is available for young girls and women (and under evaluation for men) that protects against four types of HPV.

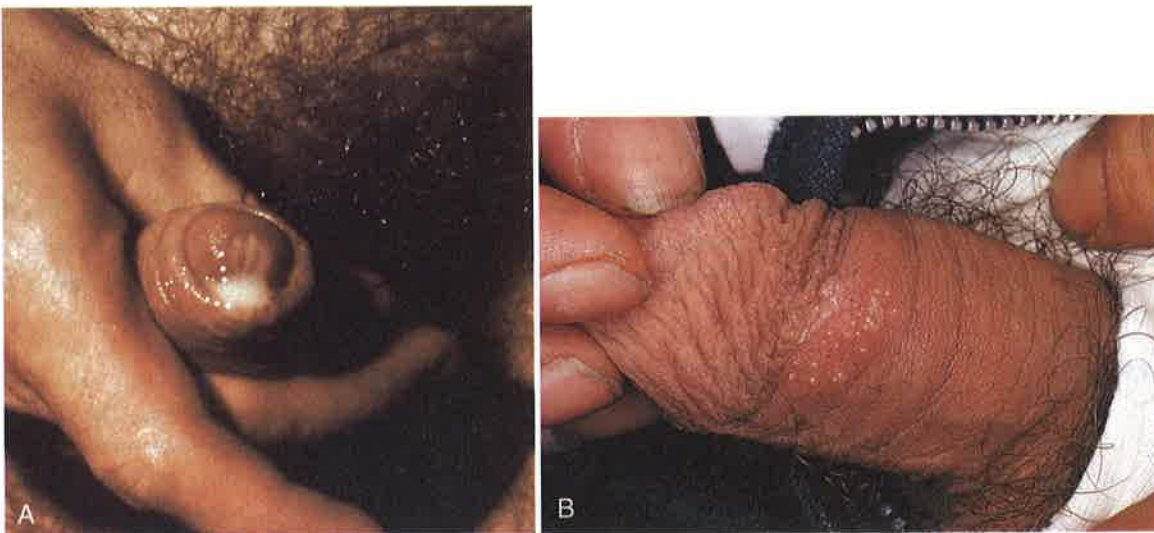


FIGURE 9-11 (A) **Gonorrhea.** Discharge from the penis can be seen. (B) **Herpes genitalis.** The classic blisters (vesicles) are evident. (A, From Morse SA et al: Atlas of Sexually Transmitted Diseases and AIDS, 2nd ed., London, 2003, Gower; B, from Swartz MH: Textbook of Physical Diagnosis, History and Examination, 4th ed., Philadelphia, Saunders, 2002.)



FIGURE 9-12 Syphilis. (A) Primary syphilis with chancre on penis. (B) Secondary syphilis showing rash on palms of the hands. This stage may last up to 2 years. (A, From Swartz MH: Textbook of Physical Diagnosis, History and Examination, 4th ed., Philadelphia, 2002, Saunders; B, from Callen JP et al: Color Atlas of Dermatology, 2nd ed., Philadelphia, WB Saunders, 2000.)

syphilis

Chronic STD caused by a spirochete (spiral-shaped bacterium).

A **chancre** (hard ulcer or sore) usually appears on the external genitalia a few weeks after bacterial infection (Figure 9-12A). Two to six months after the chancre disappears, secondary syphilis begins (Figure 9-12B). Tertiary syphilis includes damage to the brain, spinal cord, and heart, which may appear years after the earlier symptoms disappear. Syphilis (which was so often fatal in early times that it was known as the “great pox”—versus the more familiar smallpox) can be congenital in the fetus if it is transmitted from the mother during pregnancy. Penicillin is effective for treatment in most cases.

LABORATORY TESTS AND CLINICAL PROCEDURES

LABORATORY TESTS

PSA test

Measurement of levels of prostate-specific antigen (PSA) in the blood.

PSA is produced by cells within the prostate gland. Elevated levels of PSA are associated with enlargement of the prostate gland and may be a sign of prostate cancer.

semen analysis

Microscopic examination of ejaculated fluid.

Sperm cells are counted and examined for motility and shape. The test is part of fertility studies and is required to establish the effectiveness of vasectomy. Men with sperm counts of less than 20 million/mL of semen usually are sterile (not fertile). Sterility can result in an adult male who becomes ill with mumps, an infectious disease affecting the testes (inflammation leads to deterioration of spermatozoa).

CLINICAL PROCEDURES**castration****Surgical excision of testicles or ovaries.**

Castration may be performed to reduce production and secretion of hormones that stimulate growth of malignant cells (in breast cancer and prostate cancer). When a boy is castrated before puberty, he becomes a eunuch (Greek, *eune*, couch; *echein*, to guard). Male secondary sex characteristics fail to develop.

circumcision**Surgical procedure to remove the prepuce of the penis.**

See Figure 9-10B.

digital rectal examination (DRE)**Finger palpation through the anal canal and rectum to examine the prostate gland.**

See Figure 9-9.

photoselective vaporization of the prostate (GreenLight PVP)**Removal of tissue to treat benign prostatic hyperplasia (BPH) using a green light laser (laser TURP).**

This minimally invasive procedure in selected cases replaces TURP for treatment of BPH.

transurethral resection of the prostate (TURP)**Excision of benign prostatic hyperplasia using a resectoscope through the urethra.**

This procedure treats benign prostatic hyperplasia (BPH). An electrical hot loop cuts the prostatic tissue; the bits of tissue (chips) are removed through the resectoscope (Figure 9-13).

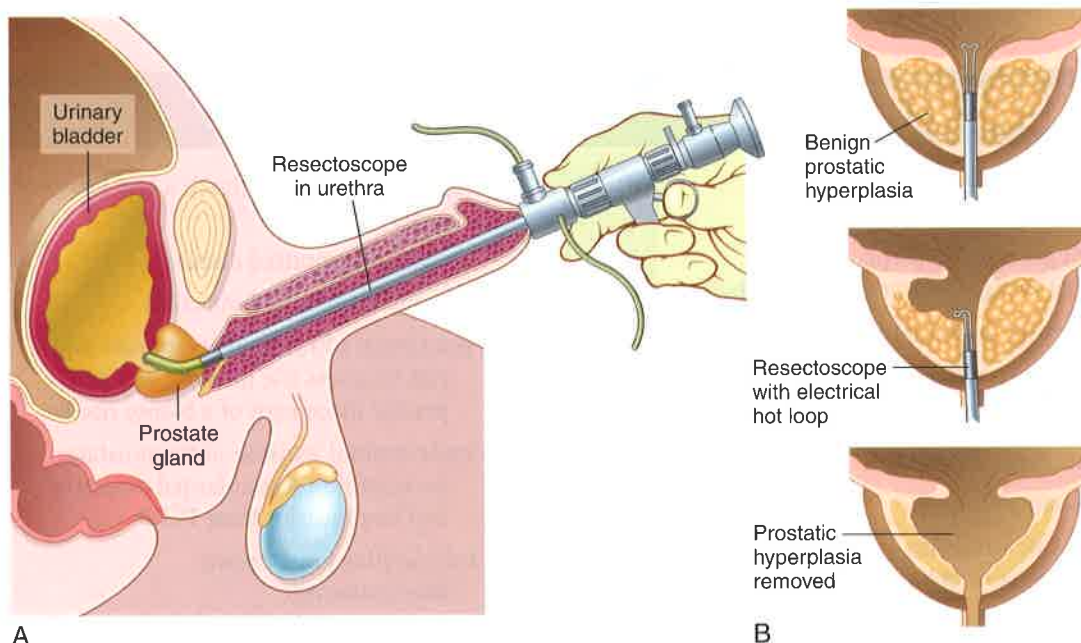


FIGURE 9-13 Transurethral resection of the prostate (TURP). (A) The resectoscope contains a light, valves for controlling irrigating fluid, and an electrical loop that cuts tissue and seals blood vessels. (B) The urologist uses a wire loop through the resectoscope to remove obstructing tissue one piece at a time. The pieces are carried by the fluid into the bladder and flushed out at the end of the operation.

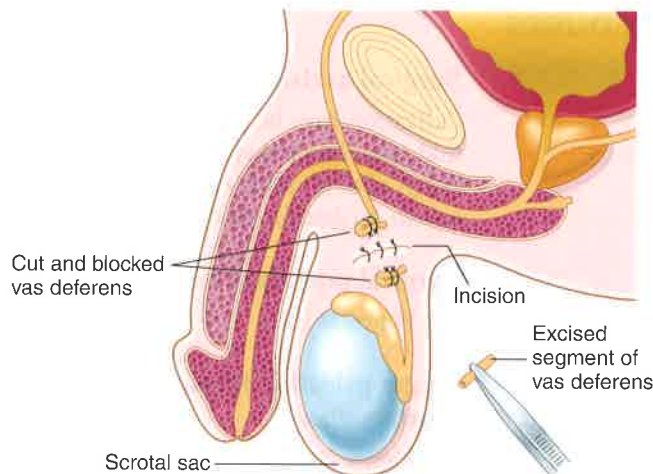


FIGURE 9-14 Vasectomy. Gleason grading system. (From Damjanov I, Linder J: *Pathology: A Color Atlas*, St. Louis, Mosby, 2000.)

vasectomy

Bilateral surgical removal of a part of the vas deferens.

A urologist cuts the vas deferens on each side, removes a piece, and performs a **ligation** (tying and binding off) of the free ends with sutures (Figure 9-14). The procedure is performed using local anesthesia and through an incision in the scrotal sac. Because spermatozoa cannot leave the body, the vasectomized male is sterile, but not castrated. Normal hormone secretion, sex drive, and potency (ability to have an erection) are intact. The body reabsorbs unexpelled sperm. In a small number of cases, a vasovasostomy can successfully reverse vasectomy.



ABBREVIATIONS

BPH	benign prostatic hyperplasia (also called benign prostatic hypertrophy)	RPR	rapid plasma reagin [test]; a test for syphilis
DRE	digital rectal examination	STD	sexually transmitted disease
ED	erectile dysfunction	STI	sexually transmitted infection
GU	genitourinary	TRUS	transrectal ultrasound [examination]; test to assess the prostate and guide precise placement of a biopsy needle
HPV	human papillomavirus	TUIP	transurethral incision of the prostate; successful in less enlarged prostates and less invasive than TURP
HSV	herpes simplex virus	TUMT	transurethral microwave thermotherapy
NSU	nonspecific urethritis (not due to gonorrhea or chlamydial infection)	TUNA	transurethral needle ablation; radiofrequency energy destroys prostate tissue
PID	pelvic inflammatory disease	TURP	transurethral resection of the prostate
PIN	prostatic intraepithelial neoplasia; a precursor of prostate cancer		
PSA	prostate-specific antigen		
PVP	photoselective vaporization of the prostate; GreenLight PVP		



PRACTICAL APPLICATIONS

Reproduced here from actual medical records is a case report on a patient with post-TURP complaints. Background data and explanations of more difficult terms are added in brackets. Answers to the questions are on page 335.

Also presented for your review is an actual surgical pathology report for a man diagnosed with prostate cancer, as well as a summary of current knowledge on anabolic steroids.

CASE REPORT: A Man with Post-TURP Complaints

The patient is a 70-year-old man who underwent a TURP for BPH 5 years ago and now has severe obstructive urinary symptoms with a large postvoid residual.

On DRE, his prostate was found to be large, bulky, and nodular, with palpable extension to the left seminal vesicle. His PSA level was 15 ng/mL [normal is 0 to 4 ng/mL] and a bone scan was negative. A CT scan revealed bilateral external iliac adenopathy with lymph nodes measuring 1.5 cm on average [normal lymph node size is less than 1 cm]. A prostatic biopsy revealed a poorly differentiated adenocarcinoma.

This patient most likely has at least stage T3 M+ disease [extension into seminal vesicles and distant metastases]. Recommendation is hormonal drug treatment [which stimulates prostatic tumor growth].

Questions about the Case Report

- Five years previously, the patient had which type of surgery?
 - Removal of testicles
 - Perineal prostatectomy
 - Partial prostatectomy (transurethral)
- What was the reason for the surgery then?
 - Cryptorchidism
 - Benign overgrowth of the prostate gland
 - Testicular cancer
- What symptom does he have now?
 - Burning pain on urination
 - Urinary retention
 - Premature ejaculation
- What examination allowed the physician to feel the tumor?
 - Palpation by a finger inserted into the rectum
 - CT scan
 - Prostate-specific antigen test
- Where had the tumor spread?
 - Testes
 - Pelvic lymph nodes and left seminal vesicle
 - Pelvic bone
- What is likely to stimulate prostatic adenocarcinoma growth?
 - Hormonal drug treatment
 - Prostatic biopsy
 - Testosterone secretion
- Stage T3 M+ means that the tumor
 - Is localized to the hip area
 - Is confined to the prostate gland
 - Has spread locally and beyond to other organs
- Why is staging of tumors important?
 - To classify the extent of spread of the tumor and to plan treatment
 - To make the initial diagnosis
 - To make an adequate biopsy of the tumor


SURGICAL PATHOLOGY REPORT: Prostate Cancer/Hyperplasia**Patient name:** Bill Scott**DOB:** 9/14/1942 (Age: 68)**Gender:** M**Clinical Data:** ?Nodule, right side; PSA 7.1**Specimen(s):**

- A. Right prostate biopsy
- B. Left prostate biopsy

FINAL PATHOLOGIC DIAGNOSIS

- A. Needle biopsy of right prostate gland (six cores)

ADENOCARCINOMA, MODERATELY TO POORLY DIFFERENTIATED

Gleason score $4 + 3 = 7$ 

Estimated tumor load, 10% of prostatic tissue

Represented in both specimens A and B

- B. Needle biopsy of left prostate gland

BENIGN HYPERPLASIA

ABOUT ANABOLIC STEROIDS

Anabolic steroids are male hormones (androgens) that increase body weight and muscle size and may be used by doctors to increase growth in boys who do not mature physically as expected for their age. Steroids also may be used by athletes in an effort to increase strength and enhance performance; however, significant detrimental side effects of these drugs have been recognized:

- High levels of anabolic steroids cause acne, hepatic tumors, and sterility (testicular atrophy and oligospermia).
- In women, the androgenic effect of anabolic steroids leads to male hair distribution, deepening of the voice, amenorrhea, and clitoral enlargement.
- Anabolic steroid use also causes hypercholesterolemia, hypertension, jaundice (liver abnormalities), and salt and water retention (edema).

**Gleason Score**

The **Gleason score** (named after Dr. Donald Gleason, a pathologist who developed it in the 1960s) is based on the microscopic appearance of the prostate biopsy specimen. Cancers with a higher Gleason score are more aggressive and carry a worse prognosis. The pathologist assigns a grade (number) to the most common tumor cells and another to the next most common tumor cells. Adding these numbers together gives the Gleason score.

The scale is from 1 to 5:

- 1: small, uniform glandular cells (as in normal tissues)
- 2: more space between glandular cells; less closely packed cells
- 3: infiltration of cells into stroma (muscle); more loosely packed, darker cells (easily seen in the figure)
- 4: irregular masses of cells, with fewer glandular cells
- 5: lack of glandular cells in tissue; cells lying in sheets or layers

More well-differentiated (closer to normal) cells are given a lower grade, and poorly differentiated (malignant) cells are given a higher grade.